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THE APPLICATION OF SAMR MODEL AND SELF-EFFICACY ON CRITICAL THINKING AND PROCEDURAL KNOWLEDGE

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Abstract

The use of e-learning presents new challenges for students in terms of improving their critical thinking skills and procedural knowledge in grammar learning. As a result, lecturers need a specific framework while creating an e-learning course. The application of SAMR model is a solution. One of the most dominant traits among students is and self-efficacy. The level of student self-efficacy was controlled in this study to measure the effect of using the SAMR model. This study uses a quasi-experimental design with a factorial design. This study involved 152 students in the experimental and control groups. The research analysis technique was tested using MANOVA. The results and conclusions show that: (1) the SAMR model has a significant effect on students' critical thinking skills and procedural knowledge; (2) self-efficacy significantly affects students' critical thinking skills and procedural knowledge; and (3) a combination of learning models and self-efficacy has a significant effect on procedural knowledge, but does not significantly affect critical thinking skills. This study contributes and improves the quality of e-learning implementation techniques, particularly in the area of English learning.

Keywords: critical thinking, procedural knowledge, SAMR model, self-efficacy

Introduction

The only way to deliver education at all levels during the Covid-19 pandemic is to use online learning or e-learning (Retnaningsih, 2020)This includes studying at university level (Mukhalafatun & Hanan, 2020). As a result, it is reasonable to conclude that e-learning should be implemented. To face these challenges, lecturers need to adapt to appropriate learning delivery methods for implementing e-learning.

There is a learning model that is extensively used by educational practitioners and can be applied to e-learning, namely the SAMR model (Hamilton et al., 2016; Sockalingam & Liu, 2020). In Indonesia, the SAMR model is also being applied to implement e-learning (Ayu et al., 2021; Zainal, 2020).

In its application, this model has two functions. The first function is as a measuring tool for technology integration into learning (Bradley, 2020). Second, the SAMR model is used as a guideline for designing technology-based learning (Izza & Rusydiyah, 2020).

The use of the SAMR model as a measuring tool is carried out by placing learning activities on the SAMR model hierarchy ladder (Dwiono et al., 2018; Handoko, 2020; Pfaffe, 2017). In this function, the SAMR model is not used as the basis for learning design. The SAMR model as a tool is used to develop questionnaires and assessment guidelines through observation (Kihoza et al., 2016). The results of most studies show that the use of technology in learning is limited to technology as a substitute for traditional tools (Martin, 2020). In other words, the integration of technology into learning only reaches the level of substitution and augmentation (Budiman et al., 2018; Dwiono et al., 2018).. This is because the SAMR model is not used as a guide in designing learning (Tunjera & Chigona, 2020)..

The SAMR model, in its function as a framework for designing learning (Howlett et al., 2019), is used in designing learning activities (Djiwandono, 2020) and evaluating student learning (Castro, 2018). Various disciplines use the SAMR model to design learning, both in the field of language learning (Azama, 2015; Lievens, 2018) and in other fields (Kriek et al., 2016; Nakapan, 2016; Zhai et al., 2019). In learning English, the SAMR model is also used to design learning (Harmandaoğlu Baz et al., 2018; Indratno, 2017; Jati, 2018) and evaluate the achievement of students' English skills (Lobo & Jiménez, 2017; Shouman & Momdjian, 2019). In the research of Giangiulio Lobo and Lara Jiménez (2017), the SAMR model was used to design the evaluations for grammar. Meanwhile, in the Djiwandono study (2020), the SAMR model is used to design learning activities for vocabulary.

Unlike previous research, this study adopts the SAMR model as a framework for designing English online learning in universities to improve critical thinking skills and procedural knowledge in the grammar area. Critical thinking is one of the important goals in higher education (Cruz et al., 2020) and can be taught or trained (Ennis, 2018; Siburian et al., 2019). These skills also affect student learning outcomes (Fatmawati et al., 2019) in English courses (Dehghayedi, 2020).

English proficiency can be viewed in terms of procedural knowledge (Gunawan et al., 2019). Procedural knowledge indicates how students process information obtained from understanding concepts to perform procedures for analysing and interpreting (Fardan, 2017). These two skills are interconnected because, to solve problems, critical thinking skills (Wechsler et al., 2018) and procedural knowledge are needed (Wuryaningrum et al., 2020).

Based on the results of observations in classrooms with expository learning, self-efficacy is one of the student traits that dominates in impacting learning. Self-efficacy is a belief in one's own abilities (Bandura, 1997; Peers et al., 2020; Shiau et al., 2020). This certainly affects how confident students are (Fryer & Oga-Baldwin, 2017), especially in using technological equipment, including software used in online learning. This then affects how students participate in online learning with various challenges and affects how students complete their assignments.

Thus, the purpose of this study is to find out: (1) differences in critical thinking skills and procedural knowledge between students who follow the SAMR model and expository strategies; (2) differences in critical thinking skills and procedural knowledge between students who have self-efficacy levels: low, medium, and high; and (3) the interaction between the SAMR model and self-efficacy on critical thinking skills and procedural knowledge of students.

Method

In this study, a quasi-experimental design was used. A quasi-experiment involves an experimental group and a control group, where individuals are not randomly assigned to a group (Creswell & Creswell, 2018). The research design used a pretest-posttest control-group design. The two groups, namely the experimental group with the SAMR model and the control group with the expository strategy, were given a pretest, but only the experimental group was given experimental intervention, then both groups were given a posttest (Leavy, 2017).

The type of experiment in this research is a factorial design. The factorial design is used because this study also considers other independent variables, often called moderator variables in research, namely the self-efficacy variable. The treatment unit used is a factorial of 2×3.

The research was conducted at one of the universities in Surabaya in November 2020-January 2021. The research population was 683 students. The sampling technique used is the Cluster Sampling technique. This study used a sample of 2 experimental classes totaling 77 students and 2 control classes totaling 75 students.

The level of English self-efficacy of the entire sample from both groups was measured before the learning started. To measure the level of students' English self-efficacy, the English self-efficacy questionnaire developed by Sağlam & Arslan (2018) was used. Then the students' self-efficacy scores were categorized into three categories, namely high, medium and low (Bandura, 1988; Indrawati et al., 2020). The pretest and posttest instruments given to students are based on the tests of critical thinking skills and procedural knowledge of grammar developed by Alfiana et al. (2021).

Prerequisite tests were carried out on the data obtained. Prerequisite tests include normality and homogeneity tests. The normality test was carried out using the Shapiro Wilk test because the research sample was less than 200 (Psaradakis & Vávra, 2020; Yap & Sim, 2011). The homogeneity test was carried out by testing the variance using the Levene test method. After the prerequisite test is done, the next step is to test the hypothesis. Hypothesis testing was carried out by using the Multivariate Analysis of Variance (MANOVA).

Findings and Discussion

Normality Test Results

The normality test was conducted to determine whether the research data obtained was normally distributed. The results of Shapiro Wilk's normality test are presented in Table 1.

Table 1. Normality Test Results

Data Group	Group	Significance
Critical Thinking Skills	Experiment	0.111
	Control	0.106
Procedural Knowledge	Experiment	0.055
	Control	0.09

The data is declared normally distributed if the significance value is more than 0.05. From Table 1, the data in all data groups is declared normal because the significance value obtained is greater than 0.05.

Homogeneity Test Results

A homogeneity test was conducted to determine whether the data variance of the two groups was homogeneous or heterogeneous. If the two groups have the same variance, then the group is said to be a homogeneous group. The data is said to be homogeneous if the data test produces a significance value greater than 0.05. Table 2 shows the results of the homogeneity test using the Levene test.

Table 2. Homogeneity Test Results

	Pre-test	Post-test
Critical Thinking Skills	0,059	0,099
Procedural Knowledge	0,176	0,074

Based on table 2, it is known that the significance value of the four data groups is more than 0.05, so all data groups are declared homogeneous.

MANOVA test

The data tested in the hypothesis test is data on the level of self-efficacy, critical thinking skills, and procedural knowledge in both groups who have participated in SAMR and expository learning. The test decisions are taken by comparing the obteained level of significance. If the significance value is less than 0.05, then H_0 is rejected so that H_1 is accepted (Sig < 0.05). The results of the MANOVA test are in Table 3.

Table 3. MANOVA Result

Independent Variable	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Significancy
Learning model	Critical Thinking Skills	4240.19	1	4240.19	43.59	0.000
	Procedural Knowledge	3235.63	1	3235.63	29.05	0.000
Self-efficacy	Critical Thinking Skills	8608.25	2	4304.13	44242.00	0.000
	Procedural Knowledge	9019.06	2	4509.53	40.28	0.000
Learning model * Self-efficacy	Critical Thinking Skills	714.56	2	357.28	3.67	0.028
	Procedural Knowledge	494.64	2	247.32	2.21	0.113

Based on the results of the MANOVA test, the significance value between the learning model and critical thinking skills is 0.00, where the value is less than 0.05 (0.00 < 0.05). These results indicate that there are differences in students' critical thinking skills based on the applied learning model. In other words, there are differences in the mastery of critical thinking skills between the SAMR and expository learning groups. This conclusion is supported by the comparison of the higher SAMR group mean scores. Table 4 is a table of differences in the average value of critical thinking skills:

Table 4. Means Differences in Critical Thinking Skills

Group	Critical Thinking Skill Means
SAMR	71.8
Expository	71.6

The significance value between the learning model and procedural knowledge is 0.00 (0.00 < 0.05). The conclusion is that there are differences in students' mastery of procedural knowledge based on the application of the learning model. This conclusion is supported by the average value of procedural knowledge, as shown in table 5.

Table 5. Means Differences in Procedural Knowledge

Group	Procedural Knowledge Means
SAMR	74.9
Expository	74.6

The level of significance between self-efficacy and critical thinking skills is 0.00. So it is evident that H_0 is rejected because 0.00 is less than 0.05. Thus, it is proven that there are differences in critical thinking skills between students with low, medium and high levels of self-efficacy. Then, the significance value between self-efficacy and procedural knowledge was 0.00. Thus, there are differences in the mastery of procedural knowledge based on the level of self-efficacy.

To find out the interaction between the learning model and self-efficacy on the two dependent variables, it can be answered by looking at the MANOVA test results with consideration of decision making. If the significance value is more than 0.05, then H_0 is rejected. From the MANOVA test, it was concluded that the combination of learning models and self-efficacy on critical thinking skills had no interaction because the significance value obtained was 0.028 (0.028 < 0.05). Meanwhile, the combination of learning models and self-efficacy on procedural knowledge has an interaction because the significance value obtained is 0.113 (0.113 > 0.05).

Discussion

Comparison of Critical Thinking Skills and Procedural Knowledge in SAMR and Expository Learning Groups

Based on the results of research data analysis, there are differences in the mastery of critical thinking skills and procedural knowledge between students who take SAMR and expository learning. A comparison of the mean scores between the SAMR group and the expository group showed that the SAMR group had a higher mean score. This is because the SAMR model that has been carried

out at all levels provides opportunities for students to use critical thinking skills (Handina et al., 2020; Warsen & Vandermolen, 2020).

The application of the SAMR model in this study is a series of learning activities that emphasize the use of technology (Bauder et al., 2020), which can increase the active role of students in learning (Barquero & Arce, 2020). Therefore, this model is suitable to be applied because in the implementation of online learning, the role of the lecturer is not as optimal as during face-to-face learning. So that students learn more independently. In addition, online learning relies heavily on the use of technology. Therefore, the application of the SAMR model that emphasizes technology integration in learning is the right solution (Wills & Baker, 2017, 2018).

By playing an active role in the learning process, students form their own knowledge. Before starting learning, students are given information about the material to be studied and directed to learning resources that can be used to study the material. So that students have time to study the material independently. Then, at the virtual meeting, students can discuss what they have learned. Thus, students' procedural knowledge of grammar is better than the expository group, which only receives material from the lecturer. So, learning based on the use of technology is proven to be able to increase knowledge mastery (Y.-T. Chen et al., 2019; Pirttimaa et al., 2017; Zulnaidi & Zakaria, 2012).

From the lowest SAMR model hierarchy, namely substitution, to the highest, namely redefinition, it emphasizes the use of technology (Zhai et al., 2019). The students involved in this research have knowledge of the use of technology and have no difficulty using it. However, students do not understand how to use technology to learn grammar and direct their learning. So, it is necessary to design SAMR learning activities with the use of technology that helps students do their learning in a directed manner.

The application of the SAMR model in technology-based learning supports deep learning for students, thus leading to an increase in critical thinking skills (C. Chen, 2020; Franco, 2019; Shouman & Momdjian, 2019; Syawaludin et al., 2019). When students carry out learning activities in the learning transformation category, they use critical thinking skills more (Azama, 2015; Wahyuni et al., 2019), because at this stage, students not only understand but use the knowledge they have acquired to create a work.

At the substitution level, students use technology to learn grammar. Students learn grammar with digital learning resources, namely ebooks, online articles, and learning videos provided on the learning management system and WhatsApp groups. Most students use smartphones and only a few use laptops. In other words, students do not experience problems accessing the material presented in digital learning resources because students can access the material anytime and anywhere.

After studying the material independently, students' understanding was measured by using the quiz feature on the website. This learning activity is included in the Augmentation stage. In addition, in order to improve procedural knowledge, students also take advantage of the grammar check feature when learning to compose sentences in English. This feature exists in word processing programs and websites used by students.

The level of modification in the application of the SAMR model also has an effect on increasing students' procedural knowledge and critical thinking skills. Students are formed into groups of 5 to 6 members. Each group has a project, which is to study and explain tenses material by way of presentation. When studying tenses material, students learn the use of these tenses, how to compose sentences with a predetermined pattern, so that sentences are arranged correctly according to grammar rules. By doing this activity, students form their own procedural knowledge. Self-formed knowledge is longer remembered (Rokhmawan, 2018; Widiasari & Sumantri, 2020) than that given by the lecturer as in expository strategies.

Another learning activity at the modification stage is the evaluation of learning developments carried out by students together with lecturers. This activity is carried out by converting practice questions into gamified quizzes by utilizing Google forms and Kahoot. From the quiz, the lecturer gave feedback on students' performance. This evaluation allows for structured and directed learning because students know what needs to be mastered and what has not been mastered. This makes it easier to determine learning targets to achieve learning goals. It can be said that the SAMR model is easy to adapt because it is clear and simple, so that it can be interpreted with various techniques to achieve learning objectives (Batiibwe et al., 2017; Froemming & Cifuentes, 2020; Green, 2014).

In contrast to the expository strategy, which is dominated by the role of the lecturer, the SAMR model in its application is more dominated by the active role of students. As in the Redefinition stage, learning activities emphasize the active role of students in showing the achievements of their learning. This is done by creating work that is not possible without the role of technology. Because learning is done online by relying heavily on technology, the creation of digital works is an appropriate equivalent. Therefore, at the end of the lesson, students create works in the form of videos and digital letters that will be sent to themselves in the future.

In making videos, students use computer programs a lot, namely programs to take pictures for videos, such as games and powtoon programs, video editing programs, etc. The selection of the program used is not determined by the lecturer. Likewise, the display, duration, content, etc., are entirely determined by the student. As a result, the work produced by students is varied. Some of the learning videos are made in a powtoon presentation format. However, there are also stories with animations whose videos are taken from games, such as GTA.

As for writing letters, students use programs for drawing, word processing programs, etc. This work also produces various forms. Some students only write. But there are also those who make drawings using programs for drawing, such as Sketchable, Sketchbook, etc. After finishing writing the letter, the letter is sent to the lecturer through the learning management system for evaluation. Then the student sends the letter through the futureme.org website and determines what year the letter will be sent back. So, it can be concluded that the application of the SAMR model enriches the student learning experience by utilizing technology (Bauder et al., 2020).

By giving students the opportunity to create works, they can also be given the opportunity to show their learning results in a preferred way, although the form of evaluation in the form of practice questions still exists. However, making

work can help reduce boredom in learning evaluation. This is due to making students' work more enjoyable, rather than working on questions continuously.

It can be concluded that the implementation of the learning process that was passed by students from the experimental group with the SAMR model and the control group with the expository strategy were different in their learning activities. In the expository group, students also learn by using technology. However, the use of this technology is not maximized in order to achieve the best learning outcomes.

Expository learning is more centered on the lecturer with full learning resources from the lecturer. While in the implementation of SAMR learning in this study, students were given the opportunity to study independently by using a variety of digital learning sources so that they were more suitable for each student. SAMR learning also departs from learning designs that prioritize the use of technology (Zhai et al., 2019; Zhang et al., 2020). So, in this technology-based learning, the results of achieving students' critical thinking skills and procedural knowledge differ between the SAMR learning group and the expository learning group.

Comparison of Critical Thinking Skills and Procedural Knowledge of Students with Low, Medium and High Levels of Self-Efficacy

The results of the MANOVA analysis in the discussion of the previous chapter stated that there were differences in critical thinking skills between students with low, medium and high levels of self-efficacy. Before joining the learning process, the average value of the experimental group with a low level of self-efficacy was 53.3. While in the medium group, it is 66.7. Then in the high group is 76.4. So, it can be said that before participating in the learning process, the medium group had higher mastery of critical thinking skills than the low group and the high group had higher mastery of critical thinking skills than the medium group.

After following the learning process, the average value of critical thinking skills in the low group is 66.7. Meanwhile, in the medium self-efficacy group, the average value of critical thinking skills obtained after participating in the learning process is 79. Finally, in the high group, the average value obtained is 89. So, when students go through the learning process, they master thinking skills. Between groups of low, medium and high self-efficacy levels, they have different mastery of critical thinking skills.

The results of data analysis also show that there are differences in the mastery of procedural knowledge between groups with low, medium and high levels of self-efficacy. This is supported by the difference in the average value of procedural knowledge in each group both before and after going through the learning process. Before participating in the learning process, the experimental group with low self-efficacy scores had an average score of 50. While the moderate self-efficacy group scores an average of 68. Then the high self-efficacy group gets an average score of 80. So, from the average value, it is evident that the moderate self-efficacy group has a higher mastery of procedural knowledge than the low self-efficacy group. In addition, the high self-efficacy group has a higher mastery of procedural knowledge than the moderate self-efficacy group before participating in the learning process.

Before and after participating in the learning process, there were differences in the mastery of procedural knowledge in the low, medium and high self-efficacy groups. This can also be seen from the comparison of the average values of the three groups. After following the learning process, the average score for the low self-efficacy group was 66.7. Furthermore, the moderate self-efficacy group has an average value of 80.2. Then, the high group had an average score of 92.7. This also proves that although in each group there is an increase in value after participating in the lesson, the middle group has a higher average score than the low group. Likewise, the high group obtained a higher average score than the medium group.

Self-efficacy is not only being aware of the abilities you have, but also knowing how to use those abilities in a situation (Bandura, 1997; Peers et al., 2020; Shiau et al., 2020). In other words, self-efficacy describes how students believe in their own abilities and these abilities are used to face challenges to obtain an achievement. Thus, the level of self-efficacy affects how students use critical thinking skills and procedural knowledge. They have to face challenges in learning in order to obtain good results.

In the learning process, self-efficacy affects student learning behavior (Schweder, 2019). Students with high levels of self-efficacy tend to try, exert more effort, and attempt to complete tasks even when faced with challenges (Bandura, 1993; Tan et al., 2020). Students with high levels of self-efficacy tend to have good English learning achievements compared to students with lower levels of self-efficacy (Y. Chen, 2020; Teng et al., 2018).

Self-efficacy supports independent learning (Bai & Wang, 2020; Gan, Liu, et al., 2020). Students with high levels of self-efficacy are better able to manage their own learning. In the learning process, students tend to be active, determine targets or goals, choose and use appropriate strategies to complete tasks (Gan, Hu, et al., 2020; Zimmerman, 2008). In addition, students with high levels of self-efficacy see difficulties in completing assignments not as obstacles but as challenges (Bandura, 1993; Vattøy, 2020).

English self-efficacy (Al-hamed, 2019; Sağlam & Arslan, 2018) describes how students with confidence in their competence in English are able to read, write, listen and speak in English. The self-efficacy questionnaire given to students covers all English skills in an integrated manner. This means not only certain aspects, but English self-efficacy as a whole. Therefore, the level of self-efficacy of each subject in this study shows English self-efficacy as a whole.

Students who are able to speak well in English do not necessarily master grammar well. Students can express what they want to convey well, but do not pay attention to grammatical elements. Likewise, students who are able to understand spoken English well do not necessarily master grammar well. Therefore, grammar is the most difficult study in learning English (Agust et al., 2019; I. Indrawati, 2017).

However, in facing this challenge, students with high levels of self-efficacy make more efforts to improve their English skills (Sardegna et al., 2018). This is evidenced by the fact that students with high self-efficacy levels provide better learning outcomes than students with low self-efficacy (Y. Chen, 2020; Rohatgi et al., 2016; Wilson & Narayan, 2016). So it can be said that self-efficacy is a strong

predictor of student academic success (Chao et al., 2018, 2019; Sun & Wang, 2020).

Between self-efficacy and critical thinking skills, it is proven that there is a positive or related correlation (Nuraeni, 2019; Nurazizah & Nurjaman, 2018). In line with this, in this study, the results of data analysis showed that there were differences in the mastery of critical thinking skills based on the level of self-efficacy. However, both self-efficacy and critical thinking skills play an important role in higher education (Saputro et al., 2020).

In this study, self-efficacy was placed as a moderator or controlled variable in the study (Hadiwijaya et al., 2015). This means that self-efficacy is considered as a student characteristic in going through the learning process. Meanwhile, in several studies, self-efficacy is placed as an achievement to be improved in learning (Listiani et al., 2019; Muhammad et al., 2020).

Critical thinking skills and procedural knowledge are the achievements studied in this study. In other words, in this study, both are positioned as targets in learning, where the learning objective is to improve these two skills. These two skills are the result of learning from students, where the achievement of mastery is influenced by the level of self-efficacy based on the results of data analysis.

Interaction Between SAMR Model and Self-Efficacy on Critical Thinking Skills and Procedural Knowledge

The results of the hypothesis test show that there is no interaction between the learning model and self-efficacy on critical thinking skills. The learning model is a treatment or treatment given to students as research subjects. Meanwhile, self-efficacy is a characteristic of students as learners, which affects how students manage learning and complete their assignments. These two combinations of variables proved to have no effect or interaction on the mastery of critical thinking skills. This is because both the learning model as an independent variable and self-efficacy as a moderator variable stand alone in influencing critical thinking skills as the dependent variable (Utami et al., 2017).

Before learning, students' critical thinking skills from the experimental and control groups were measured through tests. The results of the pretest showed that there were different values between groups with low, medium and high levels of self-efficacy. Thus, the level of self-efficacy affects the mastery of critical thinking skills (Nuraeni, 2019; Nurazizah & Nurjaman, 2018) even before learning. Then, after learning, hypothesis testing data strengthens the relationship between the level of self-efficacy and critical thinking skills (Gurcay & Ferah, 2018).

The level of self-efficacy affects critical thinking skills in both groups. This is supported by the results of the pretest and posttest, which show the difference in the average score on the mastery of critical thinking skills based on the level of self-efficacy in the two groups. That is, the level of self-efficacy affects the mastery of critical thinking skills regardless of the learning model and learning strategies used (Dehghani et al., 2011; Gurcay & Ferah, 2018; Nurazizah & Nurjaman, 2018).

At the time of learning, students in the experimental and control groups with moderate and high self-efficacy were more active in virtual meetings. Students with moderate and high self-efficacy were more active in answering and

conveying their knowledge than students with low self-efficacy. In addition, students are also faster at doing quizzes than students with self-efficacy characteristics. In dealing with questions that rely on critical thinking skills, namely the types of grammar accuracy analysis questions, students with moderate and high self-efficacy use more strategies or methods, namely by analyzing the adverbs of time and subject in sentences.

Based on data analysis in hypothesis testing, it shows that there is an interaction between the learning model and self-efficacy on the mastery of procedural knowledge. This is because the application of the SAMR model in the learning process enriches the learning experience of each student (Bauder et al., 2020) in the experimental group. This means that every student with low to high self-efficacy levels has the same opportunity for SAMR learning.

All students in the SAMR learning group are given the same opportunity to be involved in the learning process in every learning activity that can help improve their mastery of procedural knowledge. Each student is given the opportunity to study grammar materials with their preferred learning resources, namely digital textbooks, audio and video learning. Each student learns grammatically correct English sentence structures independently and discusses them with lecturers in virtual meetings. In addition, by using the Google form and the futureme.org website, students also have the opportunity to learn how to compose English sentences with a grammatically correct structure. Student participation in technology-based learning has an influence on the mastery of procedural knowledge both in groups with low, medium and high levels of self-efficacy (Y.-T. Chen et al., 2019; Pirttimaa et al., 2017; Zulnaidi & Zakaria, 2012).

Conclusion

The critical thinking skills of students who study with the SAMR model are higher than the group of students who study expository because SAMR learning enriches the learning experience by utilizing technology. Learning activities specifically designed to improve critical thinking skills are more diverse. Procedural knowledge in SAMR learning is higher because SAMR learning allows students to learn sentence structure with various forms of learning resources. In addition, students also get equal opportunities in various learning activities designed to strengthen their mastery of procedural knowledge.

The mastery of critical thinking skills in students who have low, medium and high levels of self-efficacy is different because the level of self-efficacy affects student learning behavior. Students with higher self-efficacy use more strategies to work on questions and assignments, so their critical thinking skills increase. Mastery of procedural knowledge based on the level of self-efficacy is different because self-efficacy affects student engagement in learning. Students with higher levels of self-efficacy are more active in learning, actively answer questions, and put in more effort, so that students' mastery of procedural knowledge increases.

There is no interaction between the learning model and the level of self-efficacy for critical thinking skills, because the level of self-efficacy affects the mastery of critical thinking skills regardless of the learning model used. Another finding is that there is an interaction between the learning model and the level of

self-efficacy in procedural knowledge. All students from the self-efficacy level in the SAMR learning group are given the same opportunity to be involved in the learning process in each learning activity so as to increase their mastery of procedural knowledge. Each student is given the opportunity to study grammar material with a variety of preferred learning sources, namely digital textbooks, audio and video learning.

The limitation of this research is that the learning in the two research groups both utilize technology. However, the difference is that SAMR learning is designed by taking into account the optimal use of technology for effective learning. The implication of this research is that the SAMR model is effectively used to design online learning. Thus, the suggestion for further research is to combine the application of the SAMR model with other learning models to design more effective online and face-to-face learning.

References

Al-hamed, H. S. (2019). English learning strategies and their relation to self-efficacy, attitude and language competence among female secondary school students in Buraidah. *The International Journal for Research in Education*, *43*(3), 127–158.

Alfiana, H., Karyono, H., & Gunawan, W. (2021). Analisis butir tes keterampilan berpikir kritis dan pengetahuan prosedural grammar bahasa Inggris. *JINOTEP (Jurnal Inovasi Dan Teknologi Pembelajaran)*, *8*(1), 20-29. https://doi.org/10.17977/um031v8i12021p020

Ayu, H. D., Jufriadi, A., Mustika, S. E., Kurniawati, M., Pratiwi, H. Y., Sundaygara, C., & Hudha, M. N. (2021). How to learn oscillation and wave in SAMR framework?. *Journal of Physics: Conference Series*, *1869*(1), 1-6. https://doi.org/10.1088/1742-6596/1869/1/012160

Azama, Y. (2015). *Effective integration of technology in a high school beginning Japanese class.* (Capstone Projects and Master's Theses, California State University.) retrieved from https://digitalcommons.csumb.edu/caps_thes/517

Bai, B., & Wang, J. (2020). The role of growth mindset, self-efficacy and intrinsic value in self-regulated learning and English language learning achievements. *Language Teaching Research*, 22. https://doi.org/10.1177/1362168820933190

Bandura, A. (1988). Self-efficacy conception of anxiety. *Anxiety Research: An Internation Journal*, *1*(2), 77–98.

Bandura, A. (1993). Perceived Self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*(2), 117–148.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. WH Freeman and Company.

Barquero, V. V., & Arce, N. G. (2020). M-learning : An integrative approach to increase student engagement. *Letras*, *1*, 145–176.

Batiibwe, M. S. K., Bakkabulindi, F. E. K., & Mango, J. M. (2017). The SAMR model valid and reliable for measuring the use of ICT in pedagogy? Answers from a study of teachers of mathematical disciplines in universities in Uganda. *International Journal of Computing and ICT Research*, *11*(1), 11–30.

Bauder, D. K., Cooper, K. M., & Simmons, T. J. (2020). SAMR strategies for the integration of technology through UDL. In S. L. Gronseth & E. M. Dalton (Eds.), *Universal access through inclusive instructional design: International perspectives on UDL*. Routledge.

Bradley, T. J. (2020). Exploring the effects of an asynchronous professional development with the SAMR integration model on high school teachers' technology integration in the classroom : An action research study. *Scholar Commons (Doctoral Dissertation)*, 157.

Budiman, A., Rahmawati, R., & Ulfa, R. A. (2018). EFL teacher's belief and practice on integrating ICT in the classroom: A case study on the implementation of SAMR model in teaching reading descriptive text at MA Assalam, Sukoharjo. *Jurnal Penelitian Humaniora*, *19*(2), 39–51.

Castro, S. (2018). Google forms quizzes and substitution, augmentation, modification, and redefinition (SAMR) model integration. *Issues and Trends in Educational Technology*, *6*(2), 4–14.

Chao, C. N. G., McInerney, D. M., & Bai, B. (2018). Self-efficacy and self-concept as predictors of language learning achievements in an Asian bilingual context. *Asia-Pacific Education Researcher*, *28*(2), 139–147.

Chao, C. N. G., McInerney, D. M., & Bai, B. (2019). Self-efficacy and self-concept as predictors of language learning achievements in an Asian bilingual context. *Asia-Pacific Education Researcher*, *28*(2), 139–147.

Chen, C. (2020). Effects of the application of webquest to technology education on business management students' critical thinking psychology and operation capability. *Contemporary Educational Technology*, *13*(1), 1–8.

Chen, Y.-T., Liou, S., & Chen, S.-M. (2019). Flipping the procedural knowledge learning-a case study of software learning. *Interactive Learning Environments*, 1–14.

Chen, Y. (2020). Correlation between self-efficacy and english performance. *IJET*, *15*(8), 1–12.

Creswell, J. W., & Creswell, J. D. (2018). Research design qualitative, quantitative, and mixed methods approaches. *Fast Facts to Loving your Research Project*. Sage Publications.

Cruz, G., Payan-Carreira, R., Dominguez, C., Silva, H., & Morais, F. (2020). What critical thinking skills and dispositions do new graduates need for professional life: Views from Portuguese employers in different fields. *Higher Education Research & Development*, 1–17.

Dehghani, M., Sani, H. J., Pakmehr, H., & Malekzadeh, A. (2011). Relationship between students' critical thinking and self-efficacy beliefs in Ferdowsi University of Mashhad, Iran. *Procedia - Social and Behavioral Sciences*, *15*, 2952–2955.

Dehghayedi, M. (2020). Predictors of Iranian EFL teachers ' beliefs about language learning/teaching : Critical thinking , reflectivity and emotional intelligence in focus. *Iranian Journal of Learning and Memory*, *2*(8), 55–71.

Djiwandono, P. I. (2020). How SAMR-based vocabulary teaching shapes vocabulary learning strategies. *Teaching English with Technology*, *20*(4), 41–58.

Dwiono, R., Rochsantiningsih, D., Suparno, S., & others. (2018). Investigating the integration level of information and communication technology (ICT) in the

English language teaching. *International Journal of Language Teaching and Education*, *2*(3), 259–274.

Ennis, R. H. (2018). Critical thinking across the curriculum: A vision. *Topoi*, *37*(1), 165–184.

Fardan, A. (2017). *Pengaruh Pembelajaran laju reaksi dengan pendekatan inkuiri-eksplisit reflektif terhadap pengetahuan prosedural, epistemik dan isi di SMA*. Malang: Universitas Negeri Malang.

Franco, M. (2019). *SAMR and technology integration*. Power Learning Solutions.

Froemming, C., & Cifuentes, L. (2020). Professional development for technology integration in the early elementary grades. *Society for Information Technology & Teacher Education International Conference*, 433–439.

Fryer, L. K., & Oga-Baldwin, W. L. Q. (2017). One more reason to learn a new language: Testing academic self-efficacy transfer at junior high school. *Frontline Learning Research*, *5*(4), 61–75.

Gan, Z., Hu, G., Wang, W., Nang, H., & An, Z. (2020). Feedback behaviour and preference in university academic English courses: Associations with English language self-efficacy. *Assessment and Evaluation in Higher Education*, *46*(5), 740-755. https://doi.org/10.1080/02602938.2020.1810628

Gan, Z., Liu, F., & Yang, C. C. R. (2020). Student-teachers' self-efficacy for instructing self-regulated learning in the classroom. *Journal of Education for Teaching*, *46*(1), 120–123.

Green, L. S. (2014). Through the looking glass examining technology integration. *Knowledge Quest*, *43*(1), 36–43.

Gunawan, W., Degeng, I. N. S., Utaya, S., & Sulton. (2019). The improvement of conceptual and procedural understanding by scaffolding with responsiveness. *International Journal of Innovation, Creativity and Change*, *7*(5), 162–179.

Gurcay, D., & Ferah, H. O. (2018). High school students' critical thinking related to their metacognitive self-regulation and physics self-efficacy beliefs. *Journal of Education and Training Studies*, *6*(4), 125.

Hadiwijaya, K., Fiftiyanti, Y., Wulandari, T., Noviasari, E., Rini, I. sulistyo, Ariasti, R. F., Trizuliarti, R., & Ningsih, H. A. (2015). Efikasi diri sebagai moderator hubungan antara harapan akademik, prokrastinasi, dan stres akademik. *Management Dinamic Conference*.

Hamilton, E. R., Rosenberg, J. M., & Akcaoglu, M. (2016). The substitution augmentation modification redefinition (SAMR) model: A critical review and suggestions for its use. *TechTrends*, *60*(5), 433–441.

Handina, Rochintaniawati, D., & Nugraha, I. (2020). Students' environmental awareness in learning environmental pollution using Instagram-mediated SAMR model. *MSCEIS*, 12. http://dx.doi.org/10.4108/eai.12-10-2019.2296342

Handoko, A. G. (2020). The application of the SAMR model in the 12th-grade-English classroom of "s" senior high school. *Humanising Language Teaching*, *22*(4).

Harmandaoğlu Baz, E., Balçıkanlı, C., & Cephe, P. T. (2018). Introducing an innovative technology integration model: Echoes from EFL pre-service teachers. *Education and Information Technologies*, *23*(5), 2179–2200.

Howlett, K. M., Allred, J., Beck, D., & Mysore, A. R. (2019). An English learner service-learning project: Preparing education majors using technology and the SAMR model. *Call-Ej*, *20*(2), 128–149.

Indratno, H. D. G. (2017). Implementing SAMR model in language learning. *The 5 Celt International Conference Proceeding: Contextualizing the Trajectory of Language and Arts in Contemporary Society*, *9*, 154.

Indrawati, F. A., Wardono, W., & Junaedi, I. (2020). Mathematics literacy ability in terms of self efficacy in cooperative learning type of group investigation model with humanism approach assisted by schoology. *Unnes Journal of Mathematics Education Research*, *11*(1), 83–93.

Izza, A., & Rusydiyah, E. F. (2020). Analisis model SAMR pada guru pendidikan agama Islam dalam mengembangkan motivasi belajar siswa. *Edureligia: Jurnal Pendidikan Agama Islam*, *04*(01), 11–34.

Jati, A. G. (2018). The use of smartphone applications in English language teaching and learning. *Jurnal Sosioteknologi*, *17*(1), 144–153.

Kihoza, P., Zlotnikova, I., Bada, J., & Kalegele, K. (2016). Classroom ICT integration in Tanzania: Opportunities and challenges from the perspectives of TPACK and SAMR models. *International Journal of Education and Development Using Information and Communication Technology*, *12*(1), 107–128.

Kriek, J., Dega, B. G., Ayene, M., & Coetzee, A. (2016). A modified model of TPACK and SAMR in teaching for understanding. *Society for Information Technology & Teacher Education International Conference*, 23–28.

Leavy, P. (2017). *Research design quantitative, qualitative, art-based, and community-based participatory research approaches*. The Guilford Press.

Lievens, J. (2018). Teaching and learning writing skills in a technological age: A selective mapping of writing apps onto a structured model of the writing process. *EDULEARN18 Proceedings*, *1*, 1152–1159.

Listiani, W. O., Kadir, K., & Ruslan, R. (2019). Peningkatan kemampuan berpikir kritis matematik dan self-efficacy siswa sekolah menengah atas dengan model pembelajaran berbasis masalah kontekstual. *Jurnal Pendidikan Matematika*, *8*(1), 67–77.

Lobo, A. G., & Jiménez, R. L. (2017). Evaluating basic grammar projects using the SAMR model. *Letras*, *1*(61), 123.

Martin, T. J. (2020). *The effect of teacher perceptions and self-efficacy for technology with the use of the SAMR model*. Wingate University.

Muhammad, R., Wahyuni, L., Syahman, & Juwida, H. (2020). Melatih kemampuan berpikir kritis, ketrampilan komunikasi dan self efficacy siswa menggunakan model scientific critical thinking (SCT). *Paedagoria: Jurnal Kajian, Penelitian Dan Pengembangan Kependidikan*, *11*(1), 93–99.

Mukhalafatun, S., & Hanan, H. (2020). Studi eksploratif dampak pandemi Covid-19 terhadap proses pembelajaran e-learning di perguruan tinggi. *UrbanGreen Conference Proceeding Library*, *1*, 78–83.

Nakapan, W. (2016). *Using the SAMR model to transform mobile learning in a history of art and architecture classroom*. *2015*, 809–818.

Nuraeni, S. (2019). *Hubungan self-efficacy dengan keterampilan berpikir kritis siswa pada materi kesetimbangan kimia*. Jakarta: FITK UIN Syarif Hidayatullah Jakarta.

Nurazizah, S., & Nurjaman, A. (2018). Analisis hubungan self efficacy terhadap kemampuan berpikir kritis matematis siswa pada materi lingkaran. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *1*(3), 361–370.

Peers, C., Issartel, J., Behan, S., O'Connor, N., & Belton, S. (2020). Movement competence: Association with physical self-efficacy and physical activity. *Human Movement Science*, *70*, 102582.

Pfaffe, L. D. (2017). *Using the SAMR model as a framework for evaluating m-learning activities and supporting a transformation of learning*. St. John's University (New York).

Pirttimaa, M., Husu, J., & Metsärinne, M. (2017). Uncovering procedural knowledge in craft, design, and technology education: A case of hands-on activities in electronics. *International Journal of Technology and Design Education*, *27*(2), 215–231.

Psaradakis, Z., & Vávra, M. (2020). Normality tests for dependent data: Large-sample and bootstrap approaches. *Communications in Statistics-Simulation and Computation*, *49*(2), 283–304.

Retnaningsih, R. (2020). E-learning system sebuah solusi pragmatis program vokasional semasa pandemi Covid-19. *Jurnal Taman Vokasi*, *8*(1), 21–26.

Rohatgi, A., Scherer, R., & Hatlevik, O. E. (2016). The role of ICT self-efficacy for students' ICT use and their achievement in a computer and information literacy test. *Computers and Education*, *102*, 103–116.

Rokhmawan, T. (2018). Konteks, tema, skemata, memori, dan pikiran: Mendukung pembelajaran bahasa sebagai penghela ilmu pengetahuan. *Hasta Wiyata*, *1*(2), 12–29.

Sağlam, D., & Arslan, A. (2018). The development of English language skills self-efficacy scale for higher education students. *International Journal of Psycho-Educational Sciences*, *7*(2), 1–15.

Saputro, A. D., Atun, S., Wilujeng, I., Ariyanto, A., & Arifin, S. (2020). Enhancing pre-service elementary teachers' self-efficacy and critical thinking using problem-based learning. *European Journal of Educational Research*, *9*(2), 765–773.

Sardegna, V. G., Lee, J., & Kusey, C. (2018). Self-efficacy, attitudes, and choice of strategies for english pronunciation learning. *Language Learning*, *68*(1), 83–114.

Schweder, S. (2019). The role of control strategies, self-efficacy, and learning behavior in self-directed learning. *International Journal of School & Educational Psychology*, *7*(sup1), 29–41.

Shiau, W.-L., Yuan, Y., Pu, X., Ray, S., & Chen, C. C. (2020). Understanding fintech continuance: Perspectives from self-efficacy and ECT-IS theories. *Industrial Management & Data Systems*.

Shouman, D., & Momdjian, L. (2019). Deeper learning versus surface learning: The SAMR model to assess e-learning pedagogy. *International Conference on Digital Economy*, 230–238.

Siburian, J., Corebima, A. D., Ibrohim, & Saptasari, M. (2019). The correlation between critical and creative thinking skills on cognitive learning results. *Eurasian Journal of Educational Research*, *2019*(81), 99–114.

Sockalingam, N., & Liu, J. (2020). *Designing learning experiences for online teaching and learning*. *May*, 1–7.

Sun, T., & Wang, C. (2020). College students' writing self-efficacy and writing self-regulated learning strategies in learning English as a foreign language. *System*, *90*, 102221.

Syawaludin, A., Gunarhadi, & Rintayati, P. (2019). Development of augmented reality-based interactive multimedia to improve critical thinking skills in science learning. *International Journal of Instruction*, *12*(4), 331–344.

Tan, R., Polong, R., Collates, L., & Torres, J. (2020). Influence of small group discussion on the English oral communication self-efficacy of Filipino ESL learners in Central Luzon. *TESOL International Journal*, *15*(1), 100–106.

Teng, L. S., Sun, P. P., & Xu, L. (2018). Conceptualizing writing self-efficacy in English as a foreign language contexts: Scale validation through structural equation modeling. *TESOL Quarterly*, *52*(4), 911–942.

Tunjera, N., & Chigona, A. (2020). Teacher educators' appropriation of TPACK-SAMR models for 21st century pre-service teacher preparation. *International Journal of Information and Communication Technology Education*, *16*(3), 1–15.

Utami, F. D., Djatmika, E. T., & Sa'dijah, C. (2017). Pengaruh model pembelajaran terhadap pemahaman konsep, sikap ilmiah, dan kemampuan pemecahan masalah matematis ditinjau dari motivasi belajar siswa kelas IV. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *2*(12), 1629–1638.

Vattøy, K. D. (2020). Teachers' beliefs about feedback practice as related to student self-regulation, self-efficacy, and language skills in teaching english as a foreign language. *Studies in Educational Evaluation*, *64*(October 2019), 100828.

Wahyuni, S., Mujiyanto, J., Fitiyati, S. W., & Rukmini, D. (2019). *Teachers' technology integration into english instructions : SAMR model*. *443*(Iset 2019), 546–550.

Warsen, G. D., & Vandermolen, R. M. (2020). When technology works: A case study using instructional rounds and the SAMR model. *Education Leadership*, *21*(1), 163.

Wechsler, S. M., Saiz, C., Rivas, S. F., Vendramini, C. M. M., Almeida, L. S., Mundim, M. C., & Franco, A. (2018). Creative and critical thinking: Independent or overlapping components?. *Thinking Skills and Creativity*, *27*, 114–122.

Widiasari, N. K. R., & Sumantri, M. (2020). Kooperatif tipe group investigation melalui setting lesson study terhadap kompetensi pengetahuan IPA. *Jurnal Ilmiah Sekolah Dasar*, *4*(2), 143–152.

Wills, T., & Baker, C. (2018). Engaging students with synchronous online learning activities. *Innovations in Teaching & Learning Conference Proceedings*, *10*.

Wills, T., & Baker, C. (2017). Strategies to make online teaching better than face-to-face. *Innovations in Teaching & Learning Conference Proceedings*, *9*.

Wilson, K., & Narayan, A. (2016). Relationships among individual task self-efficacy, self-regulated learning strategy use and academic performance in a computer-supported collaborative learning environment. *Educational Psychology*, *36*(2), 236–253.

Wuryaningrum, R., Bektiarso, S., & Suyitno, I. (2020). The effects of knowledge-transforming text on elementary students' declarative, procedural knowledge, and motivation in environmental learning. *International Journal of Instruction*, *13*(1), 567–586.

Yap, B. W., & Sim, C. H. (2011). Comparisons of various types of normality tests. *Journal of Statistical Computation and Simulation*, *81*(12), 2141–2155.

Zainal, M. (2020). Integrasi model SAMR (subtitution, augmentation, modification, and redefinition) pada diklat jarak jauh balai diklat keagamaan Makassar. *Jurnal Widyaiswara Indonesia*, *1*(3), 155–163.

Zhai, X., Zhang, M., Li, M., & Zhang, X. (2019). Understanding the relationship between levels of mobile technology use in high school physics classrooms and the learning outcome. *British Journal of Educational Technology*, *50*(2), 750–766.

Zhang, D., Wang, M., & Wu, J. G. (2020). Design and implementation of augmented reality for English language education. In *Augmented Reality in Education* (pp. 217–234). Springer.

Zimmerman, B. J. (2008). *Goal setting: A key proactive source of academic self-regulation*. New York: Lawrence Erlbaum.

Zulnaidi, H., & Zakaria, E. (2012). The effect of using GeoGebra on conceptual and procedural knowledge of high school mathematics students. *Asian Social Science*, *8*(11), 102–106.